AGRICULTURE

Project Fact Sheet

Bioconversion of Sugar Cane Molasses

Benefits

- 33% increase in fertilizer efficiency will save 10 million tons of plant nutrients per year, resulting in a savings of $6 billion annually
- Increases fruit and vegetable yields
- Improves environmental impacts by reducing nitrogen fertilizers and promoting more CO_2-absorbing foliage growth on plants and trees
- Reduces plant stress by applying phytochelates to foliage
- Reduces waste from the sugar cane plant, which is converted into phytochelates
- Increases profits for the sugar cane industry

Applications

This technology will help the agriculture and forest products industries, as well as chemical and agri-chemical companies that would market and sell phytochelates.

Molasses bioconversion process improves crop yields while reducing nitrogen fertilizer use and groundwater contamination

Auxein Corporation is demonstrating for commercial use an organic acid phytochelate, derived from what would otherwise be a discarded portion of sugar cane, that could increase the domestic sugar industry's profit margin from near zero to 7%. Along with helping a struggling industry, the phytochelate will bring substantial improvements to crop and tree production and greatly reduce the environmental threat posed by nitrogen-based fertilizers. Currently, the amount of fertilizer used produces harmful levels of run-off that contaminates ground water with unwanted nitrogen. By utilizing organic acid phytochelates, which assist plant growth by unlocking minerals stored in soil, fertilizer use can be dramatically reduced. This would improve crop yields, remove environmental threats to ground water, and cut fertilizer costs by as much as 50%.

Sugar Cane Production

The phytochelation process converts the normally discarded portion of sugar cane into a viable fertilizer replacement that improves crop yields and lowers fertilizer run-off problems.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

Project Description

Goal: The goals of this project are to demonstrate the low-cost production of chemically defined phytochelates, which can be used to increase fertilizer efficiency, and to develop marketing strategies for phytochelate distribution.

The phytochelates in this process are derived from sugar cane by-products (molasses or raffinate). Dextrose and fructose are removed and converted to lactic and succinic acids and processed through centrifugation, clarification, filtration, and softening. This chromatographic process uses a multiple column pseudo-moving-bed design that incorporates a weak cation resin. The lactic and succinic acids are fermented in several steps to separate unwanted material, including material for use as a high protein animal feed, then are further purified and evaporated for handling and storage.

Auxein is demonstrating this new technology with assistance from the Michigan Public Service Commission and the NICE^3 Program through the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

Technology relating to the rapid and efficient conversion of cane raffinate to fermentation succinic acid has been developed. A novel high-performance strain cannot only double succinic acid production from very low-value substrates (i.e., molasses and molasses raffinates), but the proprietary strain also acclimates well to high mineral salt compositions found in molasses raffinates. Either the sale or acid form of succinate can be prepared, and quantitative product recovery is excellent.

Extensive laboratory, greenhouse, and field testing, using a wide variety of both high-value (vegetables, fruit trees, grapes) and high-volume (field corn, soybeans) test crops, have shown that fermentation succinic acid, either alone or used in a raffinate carrier system, can increase vegetative and reproductive plant growth and boost yield harvests at high statistical probabilities. Hence, major end-uses for fermentation succinic acid and fermentation succinic acid supplemented with molasses raffinate as plant growth enhancers have been demonstrated. These formulations can be used either as soil or foliar applied treatments. However, more testing has been done using soil treatments.

Industry of the Future—Agriculture

Agriculture, a target industry for the Industry of the Future initiative, emphasizes partnerships to develop technologies for using plants, crops, and their wastes as starting materials for industrial products. An agriculture industry team has been formed within OIT to facilitate agriculture industry/federal government partnerships. This team will leverage resources available to established OIT teams, such as the chemicals and forest products teams, to strengthen the contributions of the agriculture team and to bring new ideas to the service of the agriculture industry.

OIT Agriculture Industry Team Leader: Doug Faulkner (202) 586-2119.

NICE^3—National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partners for the first commercial demonstration of energy efficient and clean production manufacturing and industrial technologies. Total project cost for a single award must be cost-shared at a minimum of 50% by a combination of state and industrial partner dollars. The DOE share for each award shall not exceed $500,000 to the industrial partner and up to $25,000 to the sponsoring state agency for a maximum of $525,000.

Project Partners

Auxein Corporation
Lansing, MI

Michigan Public Service Commission
Lansing, MI

NICE^3 Program
U.S. Department of Energy
Washington, DC

For project information, contact:

Auxein Corporation
3125 Sovereign Drive, Suite B
Lansing, MI 48911-4240
Phone: (517) 882-7370
Fax: (517) 882-7521

For program information, contact:

Lisa Barnett
Program Manager, NICE^3 Program
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

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Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, DC 20585

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